What is claimed is:

1. An electrical resistive device for sensing hydrogen gas, the device comprising:

**(a)** an array of titania nanotubes open at an outwardly-directed end formed by anodizing at least a portion of a titanium layer;

**(b)** a plurality of palladium clusters having been deposited atop said array of titania nanotubes; and

**(c)** said array of titania nanotubes mechanically supported by an integral support member.

2. The device of claim 1 wherein:

**(a)** said integral support member comprises an electrically insulative substrate layer, said top surface thereof being generally smooth; and

**(b)** said titanium layer was deposited atop said integral support member by performing a deposition process selected from the group consisting of: sputtering, evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion plating, electrodeposition, screen printing, chemical vapor deposition, molecular beam epitaxy (MBE), and laser ablation.

3. The device of claim 1 wherein:

**(a)** said integral support member comprises an electrically insulative substrate layer; and

**(b)** said palladium clusters were deposited atop said array of nanotubes by performing a deposition process selected from the group consisting of: sputtering, evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion plating, electrodeposition, screen printing, chemical vapor deposition, molecular beam epitaxy (MBE), electroless deposition, and laser ablation.

4. The device of claim 1 further comprising:

(a) a plurality of metal electrode-contacts deposited atop said nanotubes with said metal clusters; and

**(b)** whereby an exposure of said array of titania nanotubes to radiant ultraviolet energy in the presence of oxygen, removes at least a portion of a contaminant, if present on said titania nanotubes.

**5.** The device of claim 1 wherein:

**(a)** said substrate layer is made of an electrically insulative material, said top surface thereof being generally smooth;

**(b)** a thin oxidized barrier layer is formed at the base of said array of nanotubes; and

**(c)** said integral support member further comprises a metal layer interposed between said substrate layer and a metal-oxide layer, with said oxidized barrier layer atop said metal-oxide layer.

**6.** The device of claim 1 wherein:

**(a)** said substrate layer is made of an electrically conductive material atop an electrically insulative base layer;

**(b)** a thin oxidized barrier layer is formed at the base of said array of nanotubes; and

**(c)** said integral support member further comprises an alumina nanoporous structure interposed between said electrically conductive substrate layer and a metal-oxide layer, with said oxidized barrier layer atop said metal-oxide layer.

**7.** The device of claim 1 wherein:

**(a)** said titanium layer is a titanium foil layer;

**(b)** said integral support member comprises a substrate layer comprised of a portion of said titanium foil layer that is not anodized; and

**(c)** said array of titania nanotubes were so formed by exposing an outwardly-directed surface of said titanium foil layer to an acidic electrolyte solution comprising a fluoride compound and an acid at a voltage selected from a range from 100 mV to 40V, for a selected time-period; and

**(d)** a thin oxidized barrier layer is formed at the base of said array of titania nanotubes.

**8.** The device of claim 1 wherein:

**(a)** said titanium layer is a doped titanium foil layer;

**(b)** said dopant comprises a material selected from the group consisting of: Pd, Pt, Sb, $Sb_2O_3$, In, $Bi_2O_3$, Ru, Nb, Ni, MgO, Au, Cr, Ag, Cu, N, and C;

**(c)** said integral support member comprises a substrate layer comprised of a portion of said doped titanium foil layer that is not anodized; and

(d) whereby an exposure of said array of titania nanotubes to radiant energy emitted within a range of frequencies from visible to ultraviolet, in the presence of oxygen, removes at least a portion of a contaminant, if present on said titania nanotubes.

**9.** The device of claim 1 wherein:

**(a)** said titanium layer is a titanium foil layer;

**(b)** said integral support member comprises a substrate layer comprised of a portion of said titanium foil layer that is not anodized; and

**(c)** said array of titania nanotubes were so formed by exposing an outwardly-directed surface of said titanium foil layer to a basic electrolyte solution at a voltage selected from a range from 100 mV to 40V, for a selected time-period within a range of 1 minute to 24 hours.

**10.** An electrical resistive device for sensing hydrogen gas, the device comprising:

**(a)** an array of titania nanotubes comprising a dopant in an amount less than 1% by mass;

**(b)** a plurality of palladium clusters having been deposited atop said array of titania nanotubes; and

**(c)** said array of nanotubes mechanically supported by an integral support member.

**11.** The device of claim 10 wherein:

**(a)** said integral support member comprises a substrate layer of an electrically insulative material;

**(b)** said array of titania nanotubes were formed by anodizing at least a portion of a titanium layer comprising said dopant; and

**(c)** said titanium layer comprising said dopant having been produced, prior to said anodizing, by depositing titanium and said dopant atop said integral support member by a co-deposition process selected from the group consisting of: co-sputtering, co-evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion implantation, ion plating, chemical vapor deposition, laser ablation, and thermal diffusion of said dopant into a deposited titanium matrix.

**12.** The device of claim 11 wherein:

**(a)** a thin oxidized barrier layer is formed at the base of said array of titania nanotubes;

**(b)** said integral support member further comprises a metal-oxide layer interposed between said electrically insulative substrate layer and said array of titania nanotubes, with said oxidized barrier layer atop said metal-oxide layer; and

**(c)** a plurality of metal electrode-contacts are deposited atop said titania nanotubes.

**13.** The device of claim 11 wherein:

**(a)** said dopant comprises a metallic material selected from the group consisting of: Pd, Pt, Sb, $Sb_2O_3$, In, $Bi_2O_3$, Ru, Nb, Ni, MgO, Au, Cr, Ag and Cu; and

**(b)** said titania nanotubes are heat treated; and

**(c)** said integral support member further comprises a metal layer interposed between said electrically insulative substrate layer and a metal-oxide layer, with said array of titania nanotubes atop said metal-oxide layer.

**14.** The device of claim 10 wherein:

**(a)** said array of titania nanotubes were formed by anodizing at least a portion of a titanium foil layer comprising said dopant, said anodizing comprising exposing an outwardly-directed surface of said foil layer to an acidic electrolyte solution comprising a fluoride compound and an acid;

**(b)** said integral support member comprises a substrate layer comprised of a portion of said titanium foil layer that is not anodized; and

**(c)** whereby an exposure of said array of titania nanotubes to radiant ultraviolet energy in the presence of oxygen, removes at least a portion of a contaminant, if present on said titania nanotubes.

**15.** An electrical resistive device for sensing hydrogen gas, the device comprising:

**(a)** an array of titania nanotubes mechanically supported by an integral support member;

**(b)** a plurality of clusters of a noble metal having been deposited atop said array of titania nanotubes after a heat treatment is performed thereto; and

**(c)** whereby an exposure of said array of titania nanotubes to radiant energy emitted within a range of frequencies from visible to ultraviolet, in the presence of oxygen, removes at least a portion of a contaminant, if present on said titania nanotubes.

**16.** The device of claim 15 wherein:

**(a)** said array of titania nanotubes were formed by anodizing at least a portion of a titanium layer comprising a dopant in an amount less than 1% by mass;

**(b)** said contaminant is so present on said titania nanotubes and is selected from the group consisting of: liquid crude petroleum, pathogens, fungi, and proteins.

**17.** The device of claim 16 wherein:

**(a)** said titanium layer is a doped titanium foil layer;

**(b)** said dopant comprises a material selected from the group consisting of: Pd, Pt, Sb, $Sb_2O_3$, In, $Bi_2O_3$, Ru, Nb, Ni, MgO, Au, Cr, Ag, Cu, N, and C; and

**(c)** said integral support member comprises a substrate layer comprised of a portion of said doped titanium foil layer that is not anodized.

**18.** The device of claim 15 wherein:

**(a)** said titanium layer is a titanium foil layer;

**(b)** said integral support member comprises a substrate layer comprised of a portion of said titanium foil layer that is not anodized; and

**(c)** said noble metal clusters were deposited atop said array of nanotubes by performing a deposition process selected from the group consisting of: sputtering, evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion plating, electrodeposition, screen printing, chemical vapor deposition, molecular beam epitaxy (MBE), electroless deposition, and laser ablation.

**19.** The device of claim 15 wherein:

**(a)** said integral support member comprises a metal-oxide layer interposed between an electrically insulative substrate layer and said array of titania nanotubes; and

**(b)** said titanium layer was deposited atop said integral support member by performing a deposition process selected from the group consisting of: sputtering, evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion plating, electrodeposition, screen printing, chemical vapor deposition, molecular beam epitaxy (MBE), and laser ablation.

**20.** The device of claim 15 wherein:

**(a)** said integral support member comprises a substrate layer of an electrically insulative material;

**(b)** said array of titania nanotubes were formed by anodizing at least a portion of a titanium layer comprising a dopant; and

**(c)** said titanium layer comprising said dopant having been produced, prior to said anodizing, by depositing titanium and said dopant atop said integral support member by a co-deposition process selected from the group consisting of: co-sputtering, co-evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion implantation, ion plating, chemical vapor deposition, laser ablation, and thermal diffusion of said dopant into a deposited titanium matrix.

**21.** An electrical resistive device for sensing hydrogen gas, the device comprising:

**(a)** an array of nanotubes open at an outwardly-directed end formed by anodizing at least a portion of a titanium layer comprising a dopant;

**(b)** said array of nanotubes having been heat treated;

**(c)** said array of nanotubes mechanically supported by an integral support member; and

**(d)** said titanium layer comprising said dopant having been produced, prior to said anodizing, by depositing titanium and said dopant atop said integral support member by a co-deposition process selected from the group consisting of: co-sputtering, co-evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion implantation, ion plating, chemical vapor deposition, laser ablation, and thermal diffusion of said dopant into a deposited titanium matrix.

**22.** The device of claim 21 adapted for use to remove a contaminant from said array of nanotubes by exposure thereof to radiant energy emitted within a range of frequencies from visible to ultraviolet, in the presence of oxygen; said contaminant selected from the group consisting of: liquid crude petroleum, pathogens, fungi, and proteins.

**23.** A method of producing an electrical resistive device for sensing hydrogen gas, the method comprising the steps of:

**(a)** forming an array of titania nanotubes open at an outwardly-directed end by anodizing at least a portion of a titanium layer;

**(b)** depositing a plurality of palladium clusters atop said array of titania nanotubes by performing a deposition process selected from the group consisting of: sputtering, evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion plating, electrodeposition, screen printing, chemical vapor deposition, molecular beam epitaxy (MBE), electroless deposition, and laser ablation; and

**(c)** said array of titania nanotubes being mechanically supported by an integral support member.

**24.** The method of claim 23:

**(a)** wherein said step of forming said array comprises exposing an outwardly-directed surface of said titanium layer to an acidic electrolyte solution comprising a fluoride compound and an acid at a voltage selected from a range from 100 mV to 40V, for a selected time-period within a range of 1 minute to 24 hours; and

**(b)** further comprising the step of, prior to said anodizing, depositing said titanium layer atop said integral support member, which comprises an electrically insulative substrate layer, by performing a deposition process selected from the group consisting of: sputtering, evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion plating, electrodeposition, screen printing, chemical vapor deposition, molecular beam epitaxy (MBE), and laser ablation.

**25.** The method of claim 23:

**(a)** wherein said titanium layer comprises a titanium foil layer, and said step of forming said array comprises exposing an outwardly-directed surface of said foil layer to an acidic electrolyte solution comprising a fluoride compound, leaving a substrate layer comprised of a portion of said foil layer that is not anodized, said integral support member comprising said substrate layer; and

(b) further comprising the step of exposing said array of titania nanotubes to radiant energy emitted within a range of frequencies from visible to ultraviolet, in the presence of oxygen to remove at least a portion of a contaminant, if present on said titania nanotubes; said contaminant selected from the group consisting of: liquid crude petroleum, pathogens, fungi, and proteins.

**26.** A method of producing an electrical resistive device for sensing hydrogen gas, the method comprising the steps of:

**(a)** forming an array of titania nanotubes open at an outwardly-directed end by anodizing at least a portion of a titanium layer comprising a dopant in an amount less than 1% by mass;

**(b)** depositing a plurality of palladium clusters atop said array of titania nanotubes by performing a deposition process selected from the group consisting of: sputtering, evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion plating, electrodeposition, screen printing, chemical vapor deposition, molecular beam epitaxy (MBE), electroless deposition, and laser ablation; and

**(c)** said array of titania nanotubes being mechanically supported by an integral support member.

**27.** The method of claim 26:

**(a)** wherein said integral support member comprises a substrate layer of an electrically insulative material; and

**(b)** further comprising the step of, prior to said anodizing, depositing titanium and said dopant atop said integral support member by a co-deposition process selected from the group consisting of: co-sputtering, co-evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion implantation, ion plating, chemical vapor deposition, laser ablation, and thermal diffusion of said dopant into a deposited titanium matrix.

**28.** The method of claim 26 wherein:

**(a)** wherein said titanium layer comprises a titanium foil layer comprising said dopant, and said step of forming said array comprises exposing an outwardly-directed surface of said doped titanium foil layer to an acidic electrolyte solution comprising a fluoride compound, leaving a substrate layer comprised of a portion

of said doped titanium foil layer that is not anodized, said integral support member comprising said substrate layer; and

**(b)** further comprising the step of exposing said array of titania nanotubes to radiant energy emitted within a range of frequencies from visible to ultraviolet, in the presence of oxygen to remove at least a portion of a contaminant, if present on said titania nanotubes; said contaminant selected from the group consisting of: liquid crude petroleum, pathogens, fungi, and proteins.

**29.** A method of producing an electrical resistive device for sensing hydrogen gas, the method comprising the steps of:

**(a)** forming an array of titania nanotubes open at an outwardly-directed end by anodizing at least a portion of a first titanium layer;

**(b)** prior to said anodizing, depositing said first titanium layer atop said integral support member, which comprises an electrically insulative substrate layer, by performing a deposition process selected from the group consisting of: sputtering, evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion plating, electrodeposition, screen printing, chemical vapor deposition, molecular beam epitaxy (MBE), and laser ablation;

**(c)** after said step of depositing said first titanium layer, depositing a second titanium layer, leaving a portion of said first titanium layer uncovered for said forming said array of titania nanotubes; and

**(d)** depositing a plurality of metal electrode-contacts atop said titania nanotubes so formed.

**30.** A method of producing an electrical resistive device for sensing hydrogen gas, the method comprising the steps of:

**(a)** forming an array of titania nanotubes open at an outwardly-directed end by anodizing at least a portion of a titanium layer;

**(b)** prior to said anodizing, depositing an aluminum layer atop an electrically insulative substrate layer;

**(c)** after said step of depositing said aluminum layer, depositing said titanium layer atop said aluminum layer by performing a deposition process selected from the group consisting of: sputtering, evaporation using thermal energy, E-beam evaporation, ion assisted deposition, ion plating,

electrodeposition, screen printing, chemical vapor deposition, molecular beam epitaxy (MBE), and laser ablation; and

**(d)** after said anodizing, heat treating said array of titania nanotubes in the presence of oxygen forming a titanium-oxide layer interposed between said aluminum layer and said array of titania nanotubes.